

APPARATUS AND METHOD FOR REAL-TIME VOLUME PROCESSING AND UNIVERSAL 3D RENDERING

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An apparatus and method for real-time volume processing and universal three-dimensional rendering (10). The apparatus includes a plurality of three-dimensional memory units; at least one pixel bus for providing global horizontal communication; a plurality of rendering pipelines; at least one geometry bus; and a control unit. The plurality of rendering pipelines each preferably include hardware for interpolation, shading, FIFO buffering, communication and lookup tables. The apparatus of the present invention may be coupled to a geometry pipeline (18) for mixing surfaces, images and volumes together in a single image. A method for performing volumetric ray casting of a 3D volume includes the steps of calculating a distance along a major projection axis from a predefined viewpoint; dividing the volume into a plurality of consecutive regions having exponentially increasing bounds; casting a plurality of rays from the viewpoint through the volume; either merging two or more rays or splitting one or more rays at the region boundaries; and repeating the ray casting and merging/splitting steps until the entire volume has been processed. The apparatus and methods of the present invention achieve true real-time performance for high-resolution volume rendering, mixing surfaces and volumes in a single image operations, including texture mapping and image-based rendering.

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